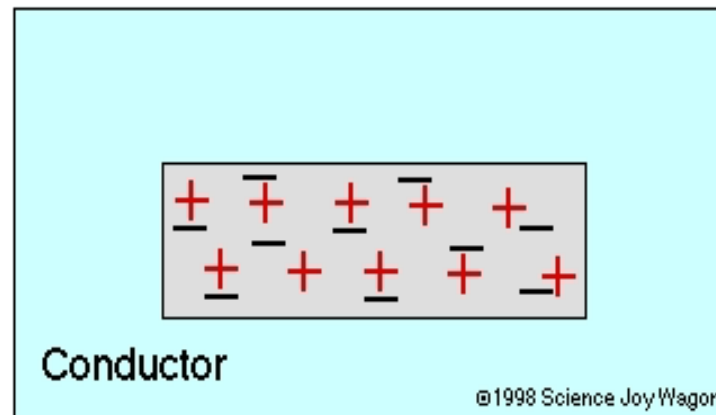


Electricity

DSHS Physical Science 2014-2015

Conductors

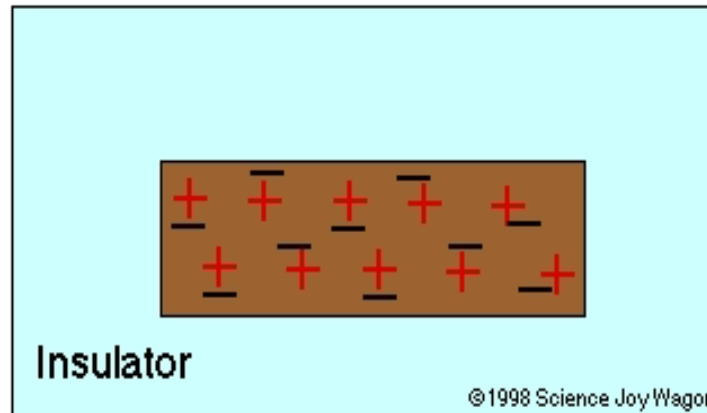
- **Conductor**
 - material that allows electrons to move through it easily
 - e^- are loosely held
 - ex: metals like copper and silver



Insulators

- **Insulator**

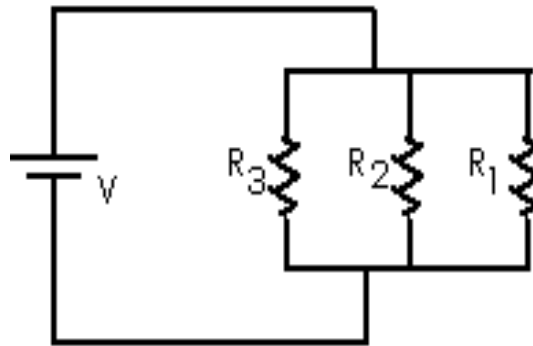
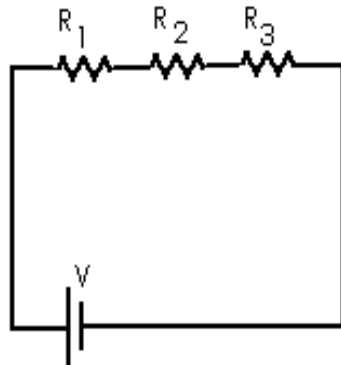
- material that doesn't allow electrons to move through it easily
- e^- are tightly held
- ex: plastic, wood, rubber, glass



A. Circuit

- **Circuit**

- When closed – it is path through which electrons can flow
- Electrons are negatively charged particles



A. VOLTAGE

- voltage = **Potential Difference**
 - difference in electrical potential between two places
 - large separation of charge creates high voltage
 - the “push” that causes e^- to move from - to +
 - measured in volts (V)

B. CURRENT

- **Current**
 - flow of electrons through a conductor
 - depends on # of e^- passing a point in a given time
 - measured in amperes (A)

C. Resistance

- **Resistance**

- opposition the flow of electrons
- electrical energy is converted to thermal energy & light
- measured in ohms (Ω)



Copper - low resistance



Tungsten - high resistance

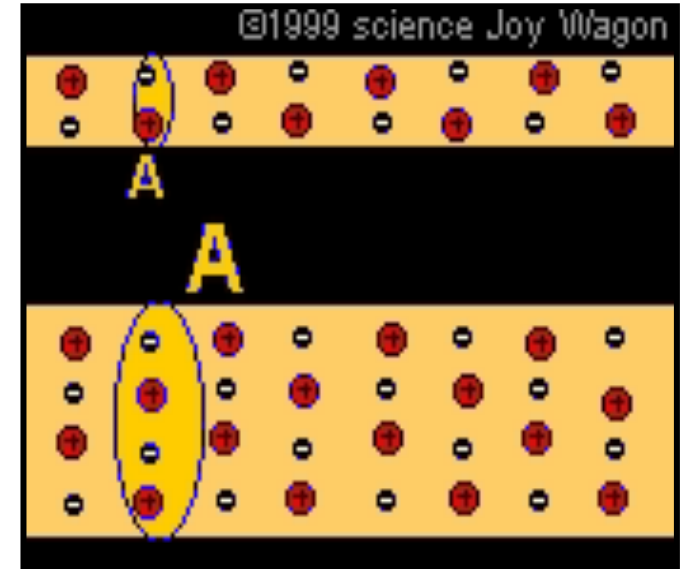
C. Resistance

- **Resistance depends on...**

- the conductor

- ◆ **wire thickness:**

- less resistance in thicker wires



- ◆ **wire length :**

- less resistance in shorter wires

- ◆ **Temperature: less resistance at low temps**

D. Ohm's Law

- Ohm's Law is all about the relationship between Voltage, current and resistance and is expressed using this equation:

$$V = I \times R$$

V: Voltage (V)

I: current (A)

R: resistance (Ω)

- Voltage increases when current increases.
- Voltage decreases when resistance increases.

D. Ohm's Law

- ★ A light bulb with a resistance of $160\ \Omega$ is plugged into a 120-V outlet. What is the current flowing through the bulb?

GIVEN:	WORK:
$R = 160\ \Omega$ $V = 120\ \text{V}$ $I = ?$	$V = I * R$

D. Ohm's Law

★ Find the resistance of a circuit that draws 0.6 amperes with 12 volts applied?

GIVEN:	WORK:
$R = ?$ $V = 120 \text{ V}$ $I = 0.06 \text{ A}$	$V = I * R$

D. Ohm's Law

- ★ Find the applied voltage of a telephone circuit that draws 17 amperes through a resistance of 15,000

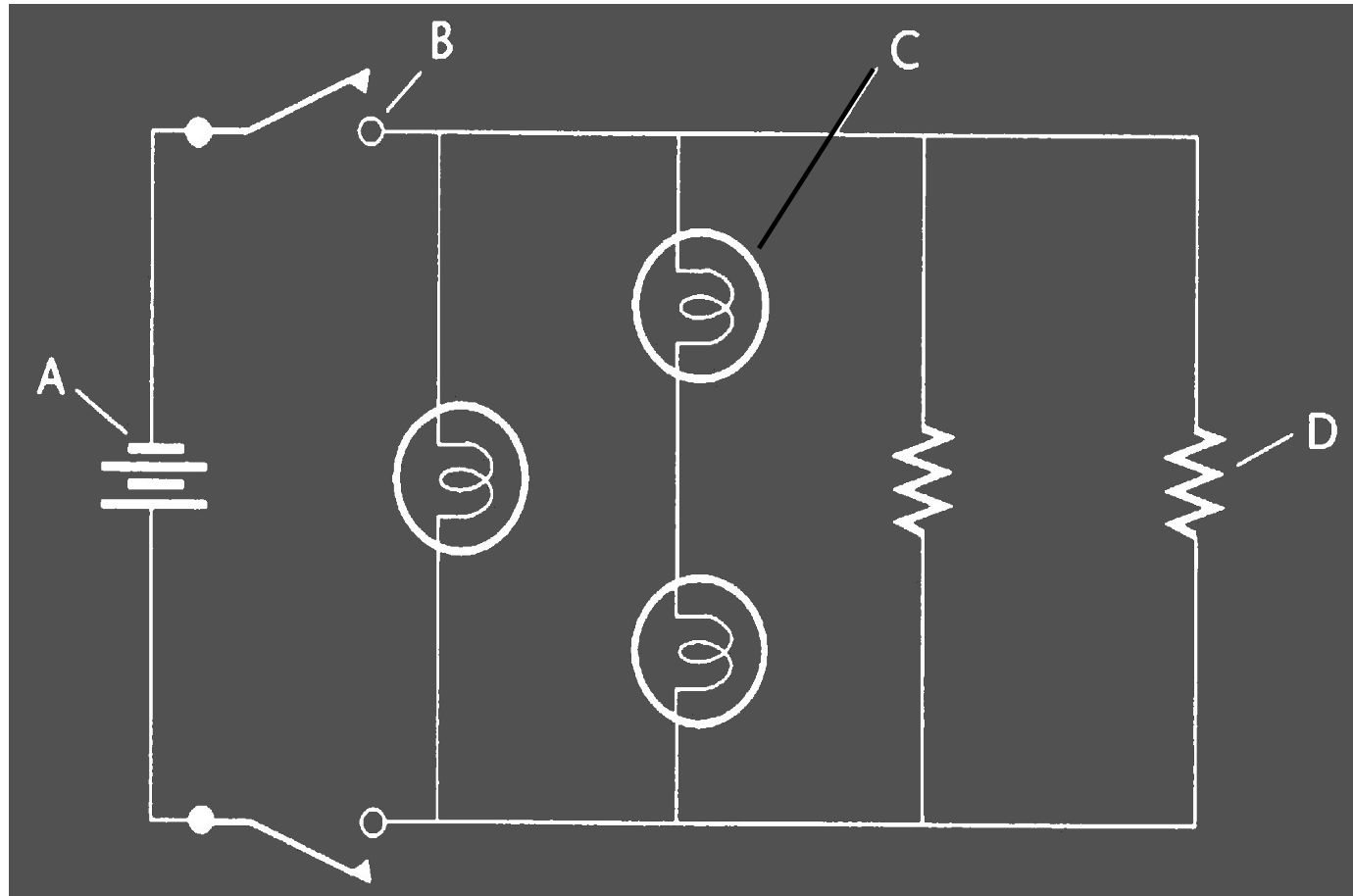
GIVEN:	WORK:
$R = 15,000 \Omega$ $V =$ $I = 17 A$	$V = I * R$

D. Ohm's Law

A 20-volt relay has a coil resistance of 200 ohms. How much current does it draw?

GIVEN:	WORK:
$R = 200 \, \Omega$ $V = 20 \, V$ $I = ?$	$V = I * R$

E. Circuit Components



A - battery

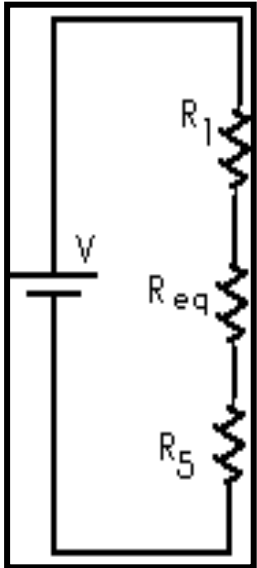
B - switch

C - light bulb

D - resistor

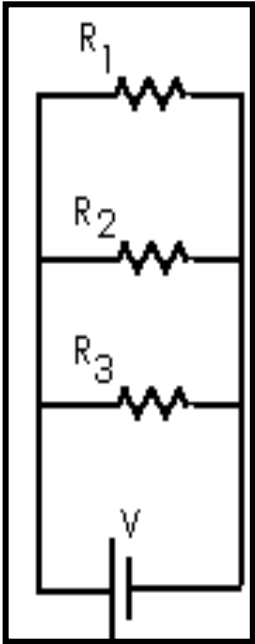
E1. Series Circuits

- **Series Circuit**



- current travels in a single path
 - one break stops the flow of current
- current is the same throughout circuit
 - lights are equal brightness
- each device receives a fraction of the total voltage
 - get dimmer as lights are added

E2. Parallel Circuits



- **Parallel Circuits**

- current travels in multiple paths
 - one break doesn't stop flow
- current varies in different branches
 - takes path of least resistance
 - “bigger” light would be dimmer
- each device receives the total voltage
 - no change when lights are added

E3. Household Circuits

- **Combination of parallel circuits**
 - too many devices can cause wires to overheat
- **Safety Features:**
 - fuse - metal melts, breaking circuit
 - circuit breaker - bimetallic strip bends when hot, breaking circuit